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LISTS OF SPECIES

Waterbirds from wetlands of the southeast of the Córdoba Province, Argentina

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ABSTRACT: We present a waterbird inventory corresponding to 66 wetlands in the southeast of the Province of Córdoba, Argentina. Sixty six waterbird species belonging to 16 families and eight orders were recorded. We report observations of 11 neartic migratory, seven partial migratory and one altitudinal migratory species. Records of *Callonetta leucophrys*, *Pluvialis dominica* and *Limosa haemastica* considered rare species for the region, were recorded in this study. Data of the relative abundance revealed 10 very abundant species, 16 abundant, 25 scarce and 12 rare, while the relative importance identified nine frequent species, 19 non-frequent and 35 occasional. This work enhances baseline knowledge of waterbirds to assist future studies in this highly threatened area with high biodiversity.

INTRODUCTION

Wetlands have important functions and values widely recognized in conservation programs at continental scales (Williams and Koenig 1980, Withers and Chapman 1993, Page *et al.* 1997). They play an important role in the evolution of basins, water purification, climate change mitigation, flood control, and replenishment of aquifers (Mitsch and Gosselink 2000). Wetlands also possess a high cultural value and support a unique biological diversity characterized by a high level of endemism of animals and plants (Ramsar 2005; Baker *et al.* 2006). Moreover, they are a refuge for protection, resting, feeding and breeding for several birds, mammals and other vertebrates, some of which are threatened by extinction (Mengui 2000).

In the Province of Córdoba, Argentina, there are more than 2 million hectares of low flood zones related to water courses (Dulce, Segundo, Cuarto and Quinto rivers), whose major extensions are located in the southern and southeastern sections of the province (Mengui 2000). These regions also represent the most productive areas of agricultural and livestock rearing, activities identified as the main causes of soil degradation and replacement of natural environments (Bertonatti and Corcuera 2000; Cabido *et al.* 2003). These environments are rich in wetlands and waterbirds (Brandolin *et al.* 2007), although they have been neglected from a conservation point of view (Bello and Ubeda 1998). In this study, we report the results of four years of ornithological expeditions conducted in the wetlands of southeast Córdoba (Argentina), including some comments on the abundance and relative importance of the waterbirds assemblage. To the best of our knowledge, this is the first exhaustive ornithological survey performed in this region.

MATERIALS AND METHODS

This work was carried out in different wetlands located in the southeast of the Province of Córdoba (Argentina) (Figure 1), within the eco-regions Pampeana and Espinal (Kraus *et al.* 1999). Wetlands in this region are mainly superficial soft-slope 1- to 4-m deep lagoons, temporary 0.5- to 2-m deep pools, and short-grass swamps with marked seasonality. According to Cantú and Degiovanni (1987) lagoons from the study area can be classified into four classes on the basis of their origin. The first class comprises "lagoons of aeolic origin associated with different types of dunes", which are elongated and egg-shaped in NNE-SSW direction, closely associated with phreatic level. The second class consists of "lagoons associated with deflation hollows", which are rounded or slightly egg-shaped, generally temporary and fed by rainwater or phreatic flow. The third are "lagoons of mixed (aeolic and tectonic) origin", which are rounded or sub-rounded without defined limits, fed by phreatic flow. Finally, the fourth are "lagoons originated by rivers", that are half-moon shaped, sub-rounded or irregular, associated to many meanders, palaeo-bed rivers or palaeo-flood plains connected to rivers. The climate of this region is moderated and becomes cooler towards the south, with rains between 600-800 mm as annual average and with 16°C of average isotherm.

A total of 314 surveys were carried out in 66 lagoons of southeast Córdoba Province in 2007 (February, May, September and December), 2008 (March, August and November), 2009 (March) and 2010 (January, May and December). We used point counts in seasonal samplings and all birds seen and heard were registered (Bibby and Burgess 1993; Bibby *et al.* 1998). The point counts were placed strategically to obtain a clear view of the water body. The number of points in each lagoon changed in relation to the area, establishing the number of points necessary to cover most of the lagoon (Kissling 2004). We remained in every point the necessary amount of time to carry out a complete sweep up to 500 m of the coastline (approximately 15 minutes per point).

For each species we calculated the relative abundance (RA) as the sum of all observations of each species in

the total sampling and categorized them in four groups: very abundant (>10,000 observations); abundant (1000-10,000 observations); scarce (100-1000 observations); and rare (<100 observations). The relative importance (RI) was calculated using the following formula:

$RI = (n_i/n_t).(m_i/m_t).100$

Where n_i: number of individuals in the species *i*, n_t: number of individuals in all species, m_i: number of samples where the species appears *i*, m_t: total number of samples. Those species having a RI >1 were considered as frequent; those having a RI from 0.02 to 0.99 are considered as non-frequent; and those with RI <0.019 are considered as occasional (Paradell *et al.* 2001). For the analysis of relative importance of the species we grouped coots (*Fulica armillata* Vieillot 1817, *Fulica rufifrons* Philippi and Landbeck 1861 and *Fulica leucoptera* Vieillot 1817) in "Fulica group" due to the difficulty to identify them over long distance, and gulls (*Chroicocephalus cirrocephalus* [Vieillot 1818] and *Chroicocephalus maculipennis* [Lichtenstein 1823]) in "Chroicocephalus group" due to the difficulty to differentiate them in winter plumage. For the list of species each one was considered separately.

Results and Discussion

In the present study we recorded 66 waterbird species belonging to 16 families and eight orders in the southeast of the Province of Córdoba, Argentina (Table 1). Families with the highest number of species were Anatidae and Scolopacidae, with 15 and 10 species, respectively.

Eleven neartic migratory species were recorded: *Pluvialis dominica* (Müller, 1776), *Limosa haemastica* (Linnaeus, 1758), *Bartramia longicauda* (Bechstein, 1812), *Tringa melanoleuca* (Gmelin, 1789), *Tringa flavipes* (Gmelin, 1789), *Tringa solitaria* Wilson, 1813, *Calidris fuscicollis* (Vieillot, 1819), *Calidris bairdii* (Coues, 1861), *Calidris melanotos* (Vieillot, 1819), *Calidris himantopus* (Bonaparte, 1826) and *Phalaropus tricolor* (Vieillot, 1819); seven partial migratory species (*i.e.* species mainly with Patagonian distribution in spring and summer, that turn up in the center of the country during autumn and winter): *Cygnus melancoryphus* (Molina, 1782), *Coscoroba coscoroba* (Molina, 1782), *Anas sibilatrix* Poeppig, 1829, *Netta peposaca* (Vieillot, 1816), *Theristicus caudatus* (Boddaert, 1783), *Charadrius collaris* Vieillot, 1818 and *Charadrius falklandicus* Latham, 1790; and one altitudinal migrant species: *Phoenicoparrus andinus* (Philippi, 1854). This later species is considered vulnerable by the IUCN (2011). Our records confirm the presence of *P. andinus* in this lagoon system where its records were currently few and doubtful (Brandolin and Ávalos 2010). Additionally, we provide records of *C. leucophrys*, *P. dominica* and *L. haemastica*, which had scattered sightings or were regarded as rare in the region.

The assemblage of waterbirds was composed by 10 (16%) very abundant species, 16 (25%) abundant, 25 (40%) scarce and 12 (19%) rare. Nine (14%) species were frequent, 19 (30%) non-frequent and the remaining were occasional. It is important to emphasize that *P. tricolor*,

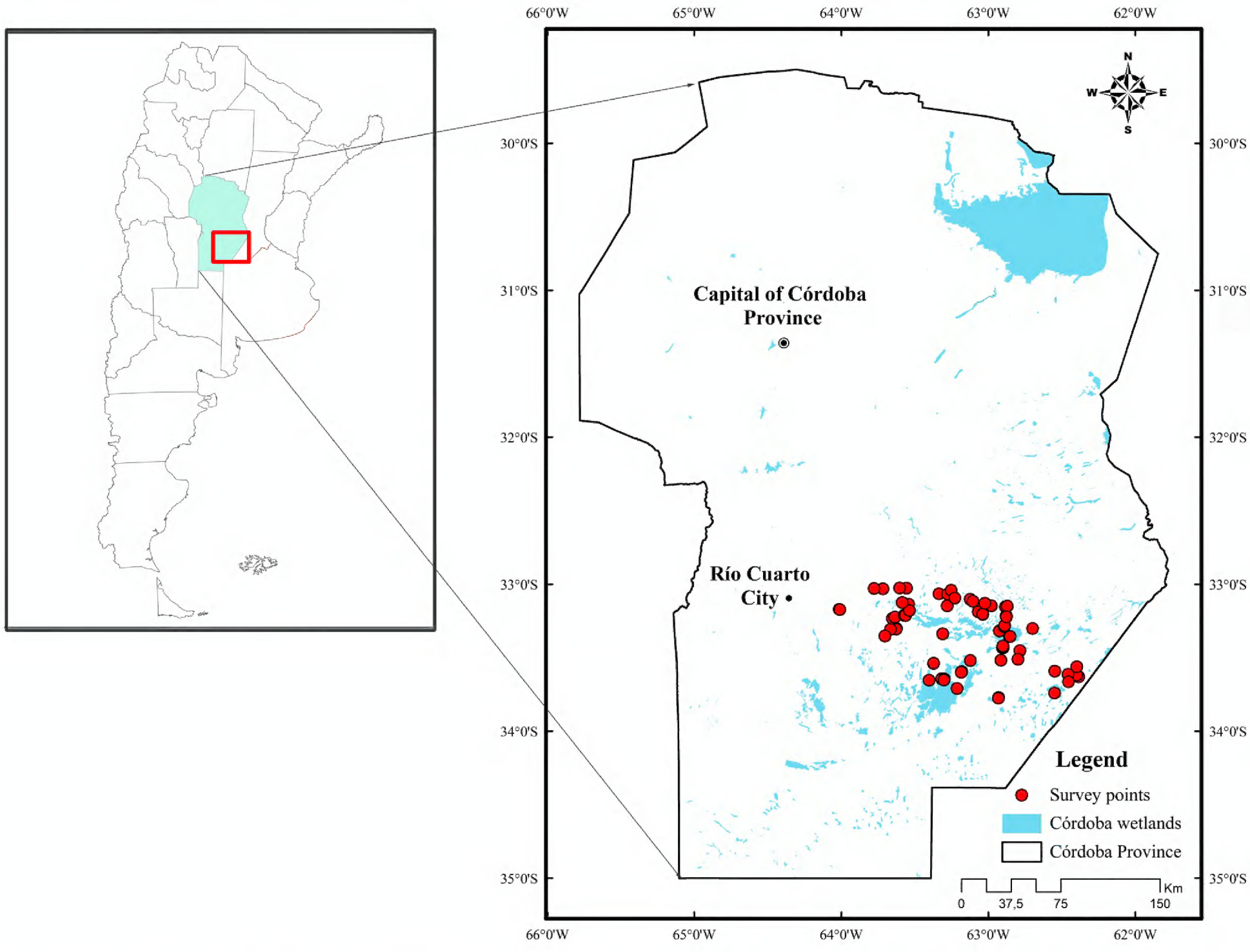

Figure 1. Study area in the southeast of Córdoba Province. The red points correspond to the sampling sites in the four years (2007-2010).

a Neartic migratory species, was a very abundant and frequent species, indicating a common large concentration of individuals of this species from September to March.

The southeast of Córdoba Province is mainly an agricultural landscape mixed with many natural wetlands. They host many aquatic birds, including some threatened species. There are few studies on wetlands of this region to compare with our results. However, we recorded 66 species of waterbirds, representing about 65% of the total waterbird species identified by Nores (1996) in the whole Córdoba Province, indicating that this is a very important region for waterbirds. Despite this, the region holds low levels of protection with only two places formally declared as reserves, the Provincial Reserve "La Felipa" and Refuge of Wildlife "Las dos Hermanas". It is important to intensify the efforts for studying and protecting wetlands of this region because they are of vital importance for the hydrological balance (Mitsch and Gosselink 2000) as well as they are habitat of a high number of bird species as described in the current study. Also important is the cultural legacy of these wetlands for the region. Our efforts contributed towards filling biological information gaps in the region and continuing studies will allow monitoring population and seasonal changes in the waterbird assemblage.

Table 1. Waterbird species recorded in 314 surveys at 66 wetlands of the south-east of the Córdoba Province, Argentina. RA (Relative abundance): VA = Very Abundant, A = Abundant, R = Rare, S = Scarce; RI (Relative Importance): Fr = Frequent, NF = Non-frequent, OC = Occasional; MS (Migratory Status): P = Partial, Alt = Altitudinal, N = Neartic. The systematic order follows Remsen *et al.* (2011).

FAMILY / SCIENTIFIC NAME	ENGLISH NAME	RA	MS	RI
ANHIMIDAE				
Chauna torquata (Oken, 1816)	Southern Screamer	R		Oc
ANATIDAE				
Dendrocygna bicolor (Vieillot, 1816)	Fulvous Whistling-Duck	S		Oc
Dendrocygna viduata (Linnaeus, 1766)	White-faced Whistling-Duck	A		NF
Cygnus melancoryphus (Molina, 1782)	Black-necked Swan	S	P	Oc
Coscoroba coscoroba (Molina, 1782)	Coscoroba Swan	A	P	NF
Callonetta leucophrys (Vieillot, 1816)	Ringed Teal	R		Oc
Anas sibilatrix Poeppig, 1829	Chiloe Wigeon	R	P	Oc
Anas flavirostris Vieillot, 1816	Yellow-billed Teal	A		NF
Anas georgica Gmelin, 1789	Yellow-billed Pintail	A		NF
Anas bahamensis Linnaeus, 1758	White-cheeked Pintail	VA		Fr
Anas versicolor Vieillot, 1816	Silver Teal	A		NF
Anas cyanoptera Vieillot, 1816	Cinnamon Teal	S		Oc
Anas platalea Vieillot, 1816	Red Shoveler	VA		Fr
Netta peposaca (Vieillot, 1816)	Rosy-billed Pochard	A	P	NF
Heteronetta atricapilla (Merrem, 1841)	Black-headed Duck	A		NF
Oxyura vittata (Philippi, 1860)	Lake Duck	A		NF
PODICIPEDIDAE				
Rollandia rolland (Quoy y Gaimard, 1824)	White-tufted Grebe	A		NF
Podilymbus podiceps (Linnaeus, 1758)	Pied-billed Grebe	R		Oc
Podiceps major (Boddaert, 1783)	Great Grebe	S		NF
Podiceps occipitalis Garnot, 1826	Silvery Grebe	A		NF
PHOENICOPTERIDAE				
Phoenicopterus chilensis Molina, 1782	Chilean Flamingo	VA		Fr
Phoenicoparrus andinus (Philippi, 1854)	Andean Flamingo	S	Alt	Oc
CICONIIDAE				
Ciconia maguari (Gmelin, 1789)	Maguari Stork	S		Oc
Mycteria americana Linnaeus, 1758	Wood Stork	R		Oc
PHALACROCORACIDAE				
Phalacrocorax brasilianus (Gmelin, 1789)	Neotropic Cormorant	A		NF
ARDEIDAE				
Ixobrychus involucris (Vieillot, 1823)	Stripe-backed Bittern	R		Oc
Nycticorax nycticorax (Linnaeus, 1758)	Black-crowned Night-Heron	R		Oc
Butorides striata (Linnaeus, 1758)	Striated Heron	R		Oc
Bubulcus ibis (Linnaeus, 1758)	Cattle Egret	VA		NF
Ardea cocoi Linnaeus, 1766	Cocoi Heron	S		Oc
Ardea alba Linnaeus, 1758	Great Egret	S		Oc
Syrigma sibilatrix (Temminck, 1824)	Whistling Heron	R		Oc
Egretta thula (Molina, 1782)	Snowy Egret	S		Oc

TABLE 1. ***CONTINUED.***

FAMILY / SCIENTIFIC NAME	ENGLISH NAME	RA	MS	RI
THRESKIORNITHIDAE				
Plegadis chihi (Vieillot, 1817)	White-faced Ibis	VA		Fr
Phimosus infuscatus (Lichtenstein, 1823)	Bare-faced Ibis	R		Oc
Theristicus caudatus (Boddaert, 1783)	Buff-necked Ibis	R	P	Oc
Platalea ajaja Linnaeus, 1758	Roseate Spoonbill	R		Oc
ARAMIDAE				
Aramus guarauna (Linnaeus, 1766)	Limpkin	R		Oc
RALLIDAE				
Pardirallus sanguinolentus (Swainson, 1838)	Plumbeous Rail	R		Oc
Gallinula chloropus (Linnaeus, 1758)	Common Gallinule	R		Oc
Gallinula melanops (Vieillot, 1819)	Spot-flanked Gallinule	R		Oc
Fulica spp.	Coots	VA		Fr
Fulica leucoptera Vieillot, 1817	White-Winged Coot			
Fulica armillata Vieillot, 1817	Red-Gartered Coot			
Fulica rufifrons Philippi and Landbeck, 1861	Red-Fronted Coot			
CHARADRIIDAE				
Vanellus chilensis (Molina, 1782)	Southern Lapwing	A		Fr
Pluvialis dominica (Müller, 1776)	American Golden-Plover	R		Oc
Charadrius collaris Vieillot, 1818	Collared Plover	R	N	Oc
Charadrius falklandicus Latham, 1790	Two-banded Plover	R	P	Oc
RECURVIROSTRIDAE				
Himantopus mexicanus (Müller, 1776)	Black-necked Stilt	VA	P	Fr
SCOLOPACIDAE				
Limosa haemastica (Linnaeus, 1758)	Hudsonian Godwit	S		Oc
Bartramia longicauda (Bechstein, 1812)	Upland Sandpiper	R	N	Oc
Tringa melanoleuca (Gmelin, 1789)	Greater Yellowlegs	S	N	NF
Tringa flavipes (Gmelin, 1789)	Lesser Yellowlegs	A	N	NF
Tringa solitaria Wilson, 1813	Solitary Sandpiper	R	N	Oc
Calidris fuscicollis (Vieillot, 1819)	White-rumped Sandpiper	VA	N	NF
Calidris bairdii (Coues, 1861)	Baird's Sandpiper	S	N	Oc
Calidris melanotos (Vieillot, 1819)	Pectoral Sandpiper	A	N	NF
Calidris himantopus (Bonaparte, 1826)	Stilt Sandpiper	A	N	NF
Phalaropus tricolor (Vieillot, 1819)	Wilson's Phalarope	VA	N	Fr
ROSTRATULIDAE				
Nycticryphes semicollaris (Vieillot, 1816)	South American Painted-snipe	R	N	Oc
LARIDAE				
Chroicocephalus spp.	Gulls	VA		Fr
Chroicocephalus maculipennis (Lichtenstein, 1823)	Brown-Hooded Gull			
Chroicocephalus cirrocephalus (Vieillot, 1818)	Gray-Hooded Gull			
Larus dominicanus Lichtenstein, 1823	Kelp Gull	A		NF
Gelochelidon nilotica (Gmelin, 1789)	Gull-billed Tern	R		Oc
Sterna trudeaui Audubon, 1838	Snowy-crowned Tern	R		Oc
RYNCHOPIDAE				
Rynchops niger Linnaeus, 1758	Black Skimmer	R		Oc

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